MechEleCiv

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Re-Founding Issue!

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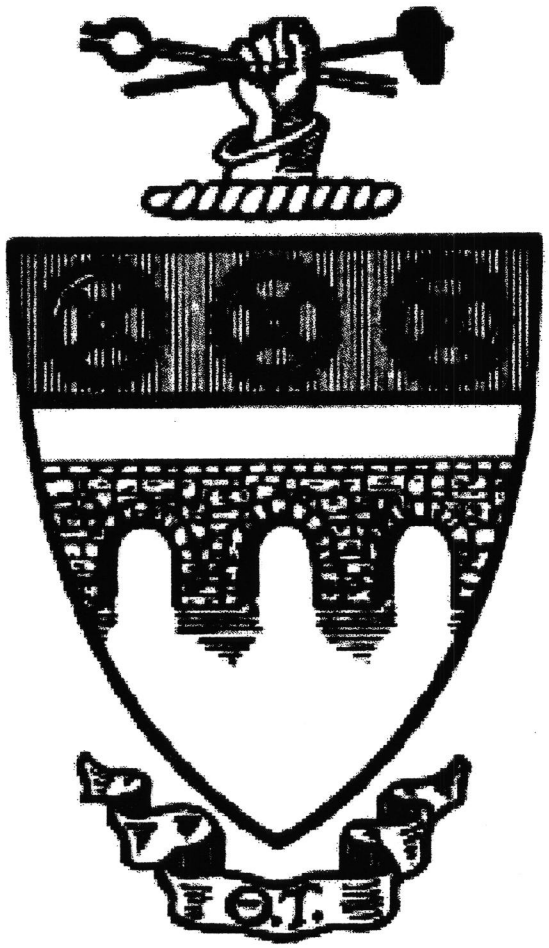
Why Theta Tau?



- Camaraderie
- Academic Achievement
- Professional Development
- Tradition
- Philanthropy
- Social Activities

Theta Tau is a national co-ed professional engineering fraternity whose purpose is to develop and maintain a high standard of professional interest among its members, and to unite them in a strong bond of fraternal fellowship.

To find out more about us,
call President Huy Nguyen at (202) 835-1521
or check out our WWW page at
http://www.seas.gwu.edu/student/thetatau.

Discover the Experience!

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Aaron Kochar

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Grant Guthrie

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Alexandra Castulovich-Montes

Photography
Claire Duggan
Aaron Kochar
Rob Piacesi

-Cover-

The U.S. Naval Research Labs graces this semester's cover. This local engineering center provides SEAS students many Co-Op opportunities (*see page 8*).

Editor's Column

A foundation stands at the center of all successful events. From a skyscraper to a college education, a strong foundation provides the ability to soar. While at times, rebuilding the MechEleCiv's foundation proved challenging, its fine tradition of service to the SEAS community made the task worthwhile.

Originally founded in 1942 by George Pida, the MechEleCiv represented engineering works at The George Washington University. It provided an opportunity for GW researchers to publish their work, as well as a medium for GW students to publicize their organizations and activities.

MechEleCiv's primary purpose, then and now, is to provide a communications link to Students, Alumni, and Faculty of SEAS. Throughout the decades, MechEleCiv survived because of its foundation in this purpose.

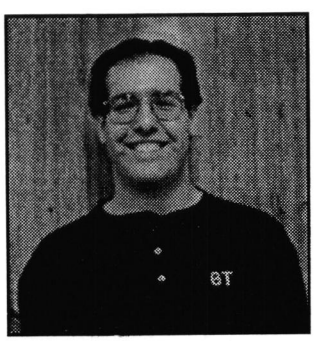
It is my greatest hope that MechEleCiv will report on the great engineering accomplishments at GW for the many years ahead.

Sincerely,

Aaron Kochar

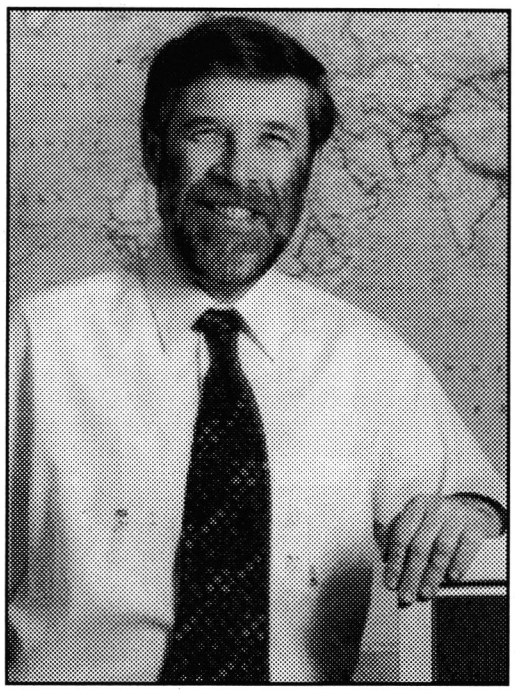
Aaron Kochar
Editor-in-Chief

MechEleCiv Congratulates Alex Jason Rosenheim



Recipient of The 1996 Norman B. Ames Award

SEAS Provides Opportunities



The nature of engineering science is fast-paced and rapidly changing. As we approach the 21st century, there are many challenges and opportunities before us, and many contributions that we, as engineers, can make to improve the physical aspects of life. In the coming century, SEAS engineers will be working on breakthrough technologies and contributing to important research findings, whether in academia or industry. These occurrences must be recorded and shared.

I am pleased, therefore, to welcome the revival of *MECHELECIV*, and hope that this unique homegrown journal will once again provide stimulating reading to the broader SEAS community, including students, faculty, alumni, and other subscribers. The research progress and results reported here are excellent examples of the vitality and richness of the SEAS engineering community.

As this journal illustrates, SEAS has established an environment where cutting-edge research and development in the engineering sciences is thriving. In addition, our scientific investigation extends beyond the academic sphere, into industry and other areas of society. SEAS laboratories, institutes, centers, and special programs are sites of focused research initiatives in such areas as materials science, computer and telecommunications systems, artificial intelligence, reliability and risk analysis, flight sciences, and space technology. This expansion of the classroom represents the true nature of engineering, which is practical, interdisciplinary, and socially active.

SEAS is also proud to have strong student and faculty collaboration in projects like the GW Solar Car, the GW Concrete Canoe, and the GW Steel Bridge. These projects add a competitive dimension to SEAS' research and development activities and provide important opportunities for engineering students to apply and adapt advanced engineering tools in practical technological processes.

At SEAS, we are not satisfied with following the latest technological trends; we are steering a course into the future with leading technologies at our command. One example is our strong effort to establish prominence in the fast-emerging areas of virtual reality, digital imaging, and knowledge-based technologies. In the past two years, we have established three new laboratories dedicated to virtual reality tools and techniques. The Computer Graphics Laboratory at the Virginia Campus, the Medical Visualization and Simulation Laboratory in Tompkins Hall; and the Naval Research Laboratory-sponsored Virtual Reality Laboratory are housing projects that open new worlds of possibilities, from virtual surgery techniques, to virtual museums, to military logistical simulations that reduce risk and costs. For these initiatives, SEAS has established key collaborations with the GW Medical School, the Smithsonian Institute, and the Naval Research Laboratory.

In this age of digital communications, there still remains a pleasure in reading a good article in print. This comeback issue of *MECHELECIV* restores to the newsstands an unique vehicle for SEAS news and technical information. Once again, I applaud the *MECHELECIV* staff and contributors for providing the SEAS community with the latest news of current project activities and ongoing research results.

Gideon Freider serves as Dean and is the A. James Clark Professor

Concrete Canoe Places Second

GW's Concrete Canoe, the Iguana, took second place on April 13 and 14 at the regional competition. GW competed against teams from Maryland, Johns Hopkins, and Catholic U. This was GW's third year participating in the nationally held Concrete Canoe Competition, sponsored by Masterbuilders and the American Society of Civil Engineers (ASCE).

GW has enjoyed success in its first two outings placing second in the regional contest at its first competition and hosting the national contest last year, where it placed in the top twenty five.

Saturday's judging was of the oral presentation, the written report and the visual display. GW constructed an 8 ft^3 replica of an Aztec pyramid. Judges walked into the towering structure to experience the team's work by looking at pictures and graphs, and reading texts.

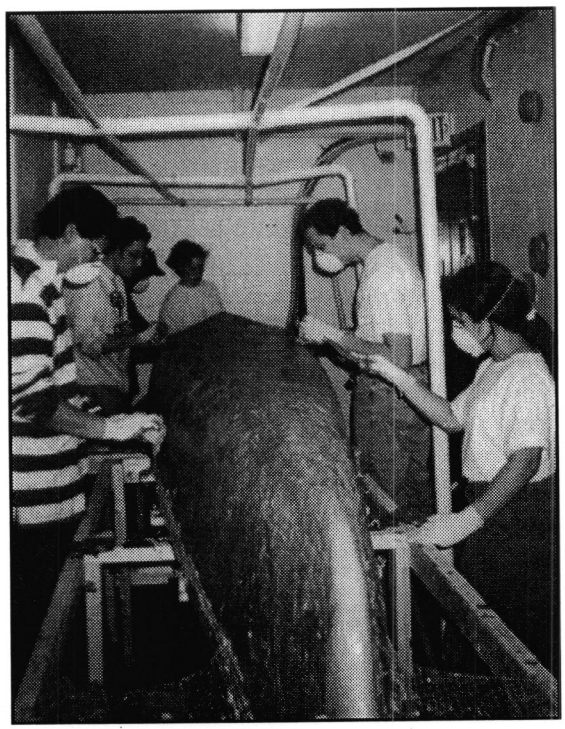
Sunday's judging was of the canoe's appearance and of the racing. The Iguana won the appearance contest. However, it had been designed for speed, and in order to minimize the drag, much maneuverability was lost. Steering the canoe seemed to be the main problem while racing.

The GW women's team placed first in the sprint competition and second in the distance competition.

"The concrete canoe project provides us with an opportunity to complement theory with practice while doing a seemingly impossible task," Project Leader Daniel Betts said.

GW set their sites on Maryland this year, with whom the team has enjoyed a friendly, yet competitive rivalry. Virtually every aspect of the canoe was improved.

More samples of concrete mixes were tested to find the correct balance of weight and strength.



Canoe members prepare the Iguana for competition.

Different ratios of cement, silica, glass bubbles and fiber mesh were used in the mixes. The glass bubbles and silica serve as an aggregate, forming a chemical bond with the cement and holding it together. The glass bubbles make microscopic voids in the concrete making it lighter but weaker. The fiber mesh is also used to bind the concrete.

In constructing the canoe, the wooden mold was first assembled and covered with steel reinforcement. The reinforcement was placed under tension prior to the concrete being applied. "We used last year's mold and modified it to the Iguana's specifications. We wanted to keep the

Iguana's Concrete Mix

	Batch 1	Batch 2
Cement	27.921 kg	9.250 kg
Silica	4.086 kg	1.362 kg
Glass Bubbles	2.043 kg	.681 kg
Fiber Mesh	0.0	.05448 kg
Water	20,471 ml	6,822.7

project as economical as possible, without compromising the final product. We built on the resources that we had from previous competitions" Betts said.

After the concrete was poured over the mold and cured for two weeks in a humidifying chamber, the tension on the wires was released.

All of the energy which had been stored in the tense wires was now being used to hold the concrete together. This is known as pre-stressing. In order to release the cement from the mold, pressurized air was injected between the mold and concrete to alleviate the vacuum. Then, the canoe was painted and prepped for presentation.

In addition to improvements made in the materials used, the overall image of the canoe needed to be reinvented. The first two canoes, "Buoyant Hopes" and "The President" seemed too limiting for this new group.

"The Iguana" was conceptualized by team leaders Betts and Erica Carr, and made a reality with the aid of the GW Art Department. The new and different motif symbolizes the spirit of the team.

"We are disappointed not to move on to nationals, but we're very proud of what we accomplished. This is definitely the best canoe ever constructed at GW," Betts said. With a strong showing this year, GW will be a contender to be reckoned with for next year's title.

~Roland Keiser

Civil Engineers Jump Off a...

Steel Bridge Enhances Training

For practicing civil engineers, building things is a way of life. However, for students, the task of constructing a steel bridge poses a major challenge. For the past nine years, the American Society of Civil Engineers (ASCE) and the American Institute of Steel Construction have sponsored a contest that asks students to meet that challenge.

On April 13, GW's Steel Bridge team attended the Steel Bridge Regional Competition at Catholic University. They competed against Howard University, Johns Hopkins, and University of Maryland. This year marked GW's second entry into the competition.

The competition is designed to simulate an actual engineering project, incorporating many problems that exist when constructing a real bridge. The situation was to build a model of a two hundred foot long bridge over a river for a mountainous area.

To accurately simulate building a typical highway bridge, the judging of the competition is based on six categories: construction speed, stiffness, weight, aesthetics, efficiency, and economy.

Using knowledge gained from last year's bridge, the team decided to attempt an under-truss bridge. Under-truss bridges can neglect road clearance, so they don't need a decking. This allows for more spacing freedom of the bridge components.

Also, with an under-truss design the bridge would be in tension which would allow the team to use one cable as opposed to a compressed arch which would require multiple components. The more components utilized, the greater the construction time and lower the efficiency.

Unfortunately, GW encountered a problem when they assembled the bridge. Two support pieces were reversed, and it took 10 minutes to diagnose the problem. Still, they were able to construct the bridge with five people in 16 minutes.

Despite overcoming the misassembly obstacle, GW's bridge was disqualified from competition. Because they couldn't get the tension in the cable they needed, it deflected beyond competition limits.

"The important thing we learned this year is that a cable is very unpredictable and is not dependable in a contest like this," project leader Alex Rosenheim said. "The time benefits of the cable system was diminished by its structural inadequacies."

Rosenheim expects that the knowledge gained from this year's attempt will greatly enhance next year's bridge.

"Every aspect of the bridge dramatically improved over last year. We attempted a daring design that pushed the limits of our engineering knowledge. Last year, we designed a bridge that could be built--this year we designed a bridge that could win. What we developed was a bridge that was stronger, more efficient, and faster to construct. If we continue on our trend of improvements, then next year we continue on to nationals."

~Aaron Kochar

Team Enjoys Success in Japan

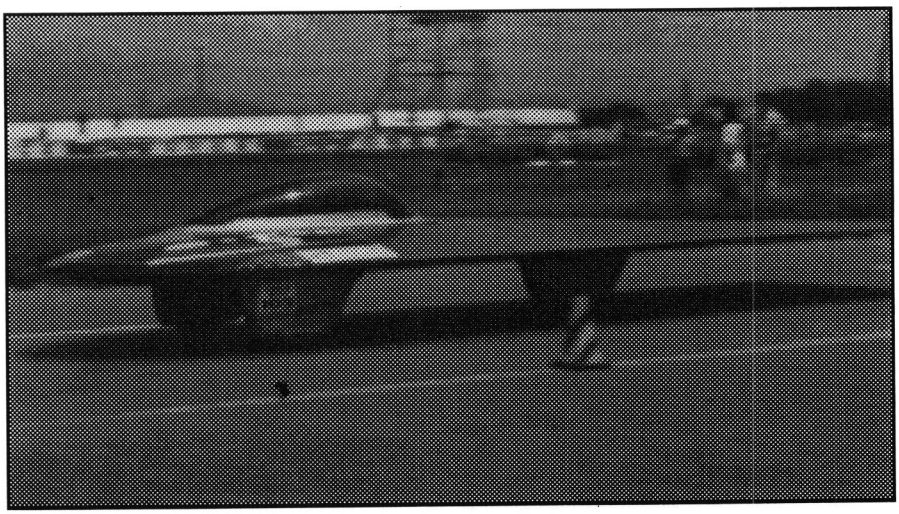
Even after a communication problem caused GW's solar car to be placed in the last starting position at the July, 1995 World Solar-Car Rally in Japan, the team achieved a first-place title in its division and finished third overall out of 90 cars.

GW's car, named "GW," surpassed every car in its Junior class as well as in the next level, the Stock class.

The two cars "GW" did not beat were the Honda Corporation and Bepal, Inc. Both of these cars were commercial entries and were categorized in the Open class, the highest level.

The World Solar-Car Rally consisted of a three-day race at the 18.6 mile Ogata-mura Solar Sports Line. Both "GW" and Bepal completed 38 laps, a total of more than 700 miles.

The misunderstanding which resulted in the lowest poll position occurred because of an interpretation error. The team thought they were supposed to report at 3:00 for the qualifications that actually began at noon.



Student Project Leader Cory Knudtson said the mistake only set the team back slightly as is shown in "GW's" overall performance.

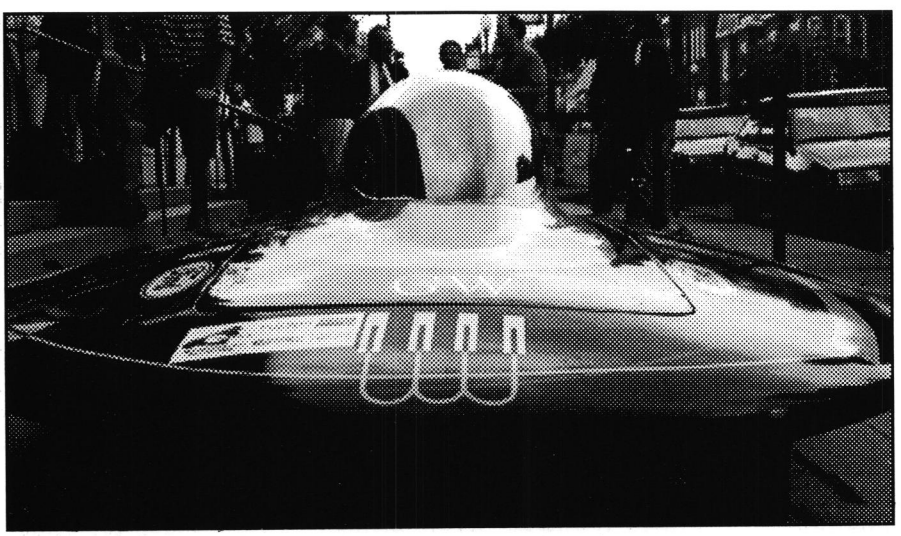
"After the first day we were in third," Knudtson said. "We felt pretty good about it." However, Knudtson believes they could have done even better because "GW" finished only a few minutes after the second place Bepal team.

"GW" cost about $250,000 to make while the price tag of Honda's car, which placed first, was in the millions.

In June, one month prior to the World Solar-Car Rally, "GW" placed fourth out of 38 cars at Sunrayce '95.

This 10-day, 1,180-mile race spanned from Indianapolis, Indiana to Golden, Colorado, and was sponsored by the U.S. Department of Energy.

"GW" qualified for the 28th poll position but at one point in the race the car advanced to second place even though the weather was filled with clouds and even heavy rain for a few days.



Above: "GW" is shown off in front of Funger Hall
Upper Right: "GW" speeds along the roads of Japan

The final standing of "GW" was fourth place behind cars from Massachusetts Institute of Technology, University of Minnesota and California State Poly-Pomona.

In addition to coming in fourth, "GW" also won the technical innovation award for best drive system, as well as the award for the best overall graphic design.

GW's first solar car, Sunforce I, also finished fourth when it competed in Sunrayce '93. In the 1993 World Solar Challenge that was held in Australia, Sunforce I came in ninth.

"This is a very big project," Knudtson said. "It's hard for those who aren't involved to comprehend this." The team had to spend many long nights in the campus garage where "GW" was built to complete it. He also said he was pleased with how hard the team worked and said it was remarkable how "everyone came together."

About 30 students worked together on this year's entry. Although team members are predominantly engineering students, other disciplines are represented.

Members from the business school solicit donations, while students with artistic flare helped to design the aesthetics of the car.

The team is composed of graduate, as well as undergraduate students.

The Solar Car Team was honored for their hard work and accomplishments with a ceremony in Funger Hall that included the presentation of a resolution from the D.C. City Council.

~Claire Duggan

Solar Car: From the Inside

What is reality to the Engineer? As we proceed through school learning our trade, one often wonders "What is it like to work out in the real world, What will I have to know?" Most of the time we do not learn the answers to these questions until it is too late. Fortunately, due to my involvement with the Solar Car at GW, I think I have learned many of the initial answers.

Four years ago, due to the coercion of several of my friends, I joined the Solar Car project at GW. This was about the same time when I started pondering the never ending "life-questions". At first I joined because I thought it would be more interesting than most of the other courses offered; and to be honest, easier both time and grade wise. I am not a very academically oriented person. My attention span to one subject without any practical or hands-on experience is very limited. As it turns out only one of my assumptions was correct.

Because Solar Car was the most interesting project or course that I have worked on during my GW experience, I was encouraged to spend time on it which made the grade part easier. The time issue ends up to be a completely different story. The amount of time and work I spent on that project when added together would add up to be more than I spent on all of my other classes through the years combined. I am not just talking about your typical 40 hours a week either. I am speaking about days and nights for months at a time. It was so bad at points that I never saw my bed for days on end and at some points I would even forget what day or time it was. People around SEAS who could attest to this would always ask, "Why? You must be an idiot for putting so much time and effort into it?" I often thought that myself at times. Although people outside of the project observed only the hard times, I learned many lessons.

However, I would say the good times outweighed the bad. I have met many of my best friends through the project. The sense of fulfillment as well as disappointment at the finish line are unexplainable. I went across the United States, Australia and Japan which were lifetime experiences in themselves. The project helped me answer those never-ending "life-questions". I learned how a real project worked, what it means to have a real deadline and the responsibility that comes with it; if I failed, it affected the whole team not just myself. I learned what it was like to design and build something from start to finish. What it was like to work with other engineers that were not in my field of study. Most of all, I was able to actually apply what I learned to a real-world situation. This aspect alone gave me the biggest reward by answering the biggest question of all, 'Am I capable?'.

So if I had the chance to do it all over again, I would. The Solar Car Project gave me a taste of reality and a sense of what it truly means to be an engineer.

~Eric Takamura

Co-Op Provides Job Experience

Through the middle of the 20th century, demand was high for engineers. Because of that, engineers with four year degrees found it easy to find jobs, relative to their peers.

However, as more and more engineering institutions emerge, producing thousands of high-quality engineers each year, the job market has become fiercely competitive.

The Cooperative Education program for SEAS through GW's Career Center provides the University's engineers with the the tools needed to succeed in the professional world.

GW's location in Washington is ideal for obtaining a co-op job. There are hundreds of companies in the Washington metropolitan area that need quality engineers, and hire engineering students to work in co-op positions.

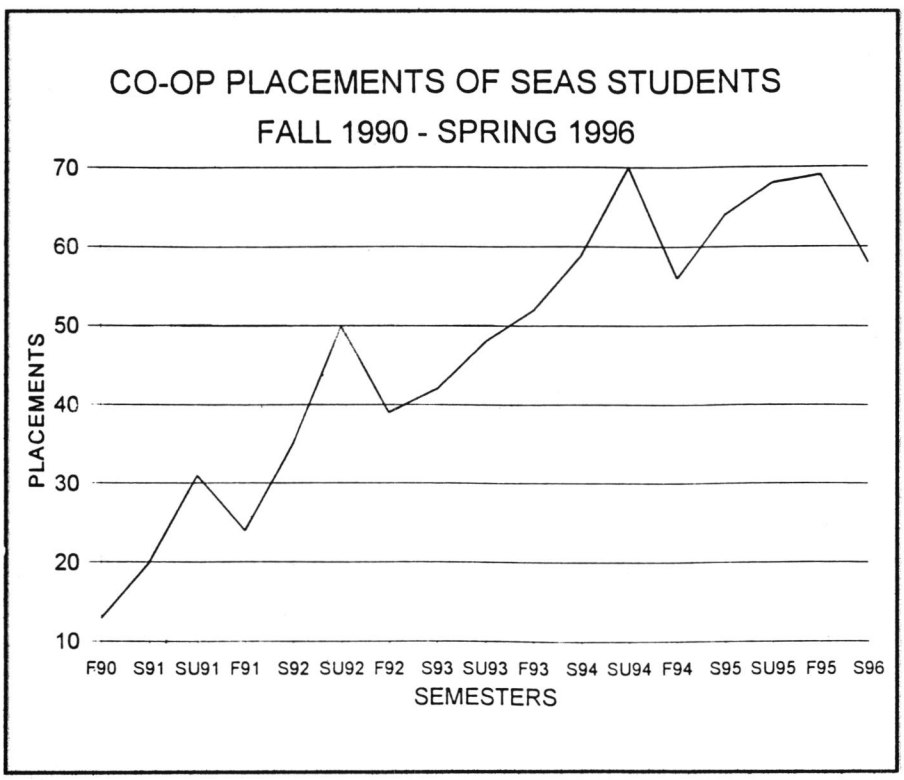
Cooperative education is an educational program which integrates academic study with paid, career-related professional experience. It is a structured educational experience and offers students a head start in a future career. Co-op is a selective, optional program that adds a dimension to a university degree that is not found in the classroom.

"I think it's an all-win program," says Bill McCarthy, Assistant Director of Cooperative Education, "students get experience and employers get a chance to bring in eager new professionals." McCarthy is responsible for dealing with the co-op positions of SEAS students.

McCarthy and the Cooperative Education department help students get their name out to employers who are looking for students to fill co-op positions.

The student is then prepared by an advisor for interviews and for becoming a member of the working world. Then after placement at a co-op job, the co-op department keeps up on the student's progress by keeping in contact with both the student and employer.

"Co-op students get a chance to begin their career development and at the same time earn money for school," McCarthy said.



Co-op of the Year

Leslie McFadden is a senior at SEAS this year majoring in Civil Engineering and is GW's *National Capital Association for Cooperative Education Honored Student* for 1996. In a ceremony held on April 11 at the University, President Stephen Joel Trachtenberg presented Leslie with her award for this accomplishment.

McFadden's current co-op assignment is with the Advent group, an environmental consulting firm, where she is working on a project to determine the feasibility of treating storm water runoff with Constructed Wetlands.

Previously, McFadden had been on a two semester co-op with Washington Gas & Light where she designed and imple-

mented a database for monitoring air emissions and ensuring permit compliance with gas production plants.

At that job McFadden used her engineering training from GW to work the powerful CAD machines at Washington Gas & Light.

"SEAS classes have given me an understanding of the technology, and my co-op job at Advent has shown me how to apply that knowledge to practical engineering problems," McFadden said.

When asked what she thought of the co-op program at SEAS, McFadden said that she "would definitely recommend it to anyone."

McFadden had a job within the first few weeks of starting the program, adding that "Bill McCarthy has done a wonderful job in getting my resume out there. When employers see 'co-op' on an application, it goes into the 'to be interviewed' pile because they know the applicant has received sound experience."

Trachtenberg congradulates McFadden as the Co-Op of the Year

Running With the Big Dogs

"I've gone to meetings where it was myself and the heads of the other departments, and they wanted to know what I thought," said Brad Crane, a senior majoring in Electrical Engineering at SEAS.

Brad has worked for three years in a co-op position with the Naval Research Laboratory. He conducts circuit design and data acquisition through implementation of those designs.

"I knew co-op at GW was a good program, and that I would need that kind of experience. Through co-op you get a real-world education, which is a big advantage. It gives experience working with equipment and materials that you can't get through a degree program," Crane said.

Crane's three years of co-op experience have put him in a pay category which is above that of graduate students with no experience. As Crane put it, "I have the equivalent of a master's degree with only a bachelor's degree. My supervisor said that I do as much work as the full-time Ph.D. workers."

Starting Out

Greg Stern, while a freshman Computer Science student at SEAS, has already set out to do big things. He attended the co-op orientation programs that the Career Center provides to students who are interested in getting a co-op job, and worked closely with McCarthy to help him get a job at the Naval Research Laboratory (NRL).

"Bill McCarthy is one of the biggest reasons I have a job. He sent my resume out to potential employers and then assisted me in picking the job that was best for me," Stern said.

Stern will be working this summer in the ENEWS program (Effectiveness of Naval Electronic Warfare Systems) at the NRL. The ENEWS program will allow Stern to work with the latest in artificial intelligence (AI). He then integrates AI into smart missile programming and uses that design in a simulated environment.

The co-op program is "one of the most impressive things about GW", says Stern. He continues on to say that his co-op job will provide "so much experience that graduate school won't be necessary. However, if I choose to go to grad school, then my employer will cover the cost for me."

~Grant Guthrie

Design Optimization with Computer-Aided Engineering

In the design environment of the 1990's, manufacturing firms will have to adopt strategies quite different from the mass production philosophy of the past. The international market is becoming increasingly competitive. Companies are becoming more efficient at meeting the basic needs of society. The most successful firms will be those that add value to their products through superior design and engineering[1, 2, 3].

The design improvement methodology discussed in this paper incorporates various forms of data obtained from FE analysis into a computer program written for optimizing the configuration of any mechanical device. It also presents the strategy employed for designing and coding the computer program developed for performing the design optimization. This code, called the Quality Assurance Software (QAS), is written with such generality that different optimization schemes can be incorporated into the design process. This code has been ported to both the DOS and UNIX operating systems and applies to the optimization of any device that can be analyzed by the finite element method.

The results of the Taguchi design configurations were evaluated by various algorithms using the Taguchi loss function and an additional loss function to determine the influence of each design parameter on the quality of the design. Algorithms were included to consider the effect of various noises, defined as parameters that are beyond the control of the manufacturing process on the design evaluation. In addition, effects of the design parameters on variations of the product quality were evaluated as part of the procedure.

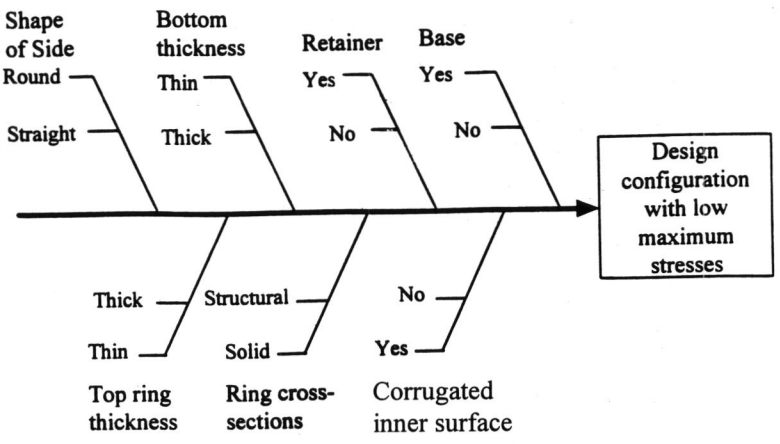


Figure 1. Cause-and-effect diagram for the redesign of conduit holder, identifying two levels for the design factors.

EXPERIMENTATION

The computer-aided engineering environment requires a realistic and accurate graphical representation of the product. A three dimensional representation of a component provides a better understanding of the design, enabling designers to make improvements based on aesthetic as well as mechanical strength considerations. Besides the improvements based on visual inspection, a design can also be optimized by analyzing the result of experiments performed on the design configurations. In CAE the experimental results are usually obtained from FE analyses, which can be expensive and time consuming.

Fortunately, Taguchi and other researchers have proposed reduced factorial design methodologies. With the Taguchi method, for example, a product design with two levels for each of the seven main factors will require only eight tests or analyses as compared to one hundred and twenty-eight from a full factorial experiment. Orthogonal arrays generally produce a lower error variance, when estimating a function, than non-orthogonal Taylor series.

CREATING TRIAL DESIGN CONFIGURATIONS

Approximately eighty-five percent of the cost of a project is

indirectly allocated during the design phase. The use of Taguchi or similar techniques can result in substantial reduction in project cost. The design process starts with a need or requirement analysis. Next is the actual design process that includes the design optimization phase. In this phase the product is studied in detail and important design factors are identified. This phase starts with a brainstorming session and the cause-and-effect diagram can aid in the process. Figure 1 shows the cause-and-effect diagram for the conduit holder design optimization problem. The goal is to determine a design configuration that has the lowest maximum stresses possible for the selected levels for the selected levels of the design parameters.

Quality Assurance Software (QAS)

The QAS code was written to provide a user-friendly interface between FEA and the SDE. The functional flow chart of the program is shown in Figure 2. Figure 2 shows a sample QAS input screen for the main design factors. QAS prepares an appropriate work sheet based on the number of design factors, the details of each design configuration, the inner and outer arrays, and the names of the FE analysis output result files.

The data used with QAS is loaded from ASCII database files, which enables different experimental arrays to be used with the program. These arrays can also be edited from inside the program to accommodate special design cases such as analyzing three or four level factors with two level experimental arrays. QAS is not hard coded for Taguchi arrays, permitting Hadamard or other user defined experimental arrays to be used [4]. These arrays are the basis for determining the sum of squares, signal-to-noise ratios, analysis of variance, sensitivity, etc. The program uses a dynamic link-list based database that can accommodate varying problem sizes. QAS can load data from ASCII files into dynamic memory tables that consist of records, fields, and cells. The data in these dynamic tables can be accessed sequentially or as elements of a matrix.

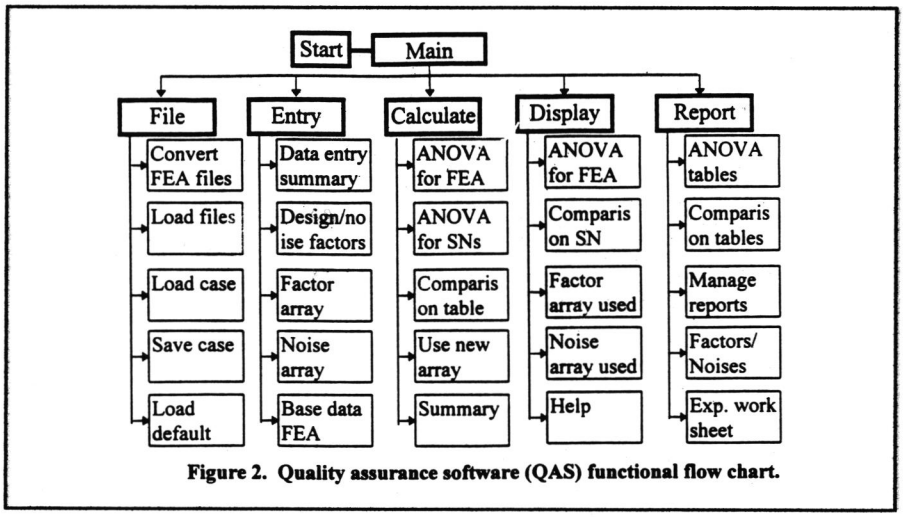


Figure 2. Quality assurance software (QAS) functional flow chart.

Finite Element Analysis

In finite element analysis the response to an applied load on the model is studied by dividing the model into distinct non-overlapping regions known as elements over which the main variables are interpolated. The variables are identified with nodal points. Loads and restraints are applied to the nodes. The complete model results in a system of

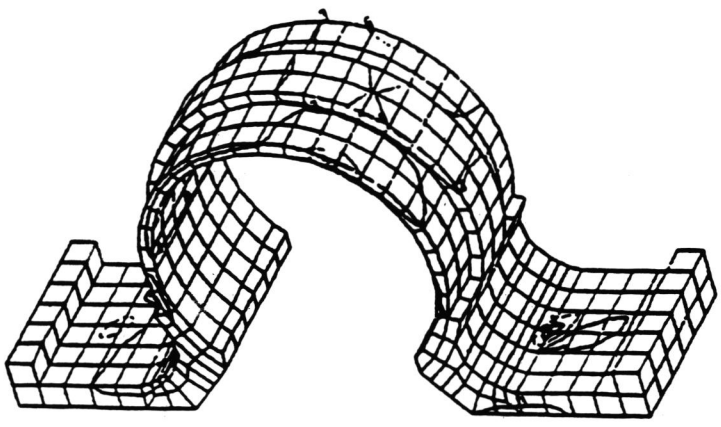


Figure 4. Conduit holder trial design configuration number two.

simultaneous equations that can be solved for displacements, strains, stresses, etc. The accurate representation of the FE model that comes through experience is a key to obtaining reliable results.

Eight FE models were analyzed for the conduit holder design. Ten highest maximum stress values from each of these eight FEA results were used for SDE [5]. Figure 4 shows the finite element model for configuration number two of the conduit holder design.

STATISTICAL ANALYSIS

The FEA results can be used to obtain the smaller-the-better (SB), nominal-is-best (NB), and the larger-the-better (LB) signal-to-noise (S/N) ratios. The Taguchi SB S/N ratio can be obtained from the expression

$$S/N_{SB} = -10\log(\frac{1}{n}\sum_{i=1}^{n} y_i^2),$$

where y is the actual value obtained from experiments.

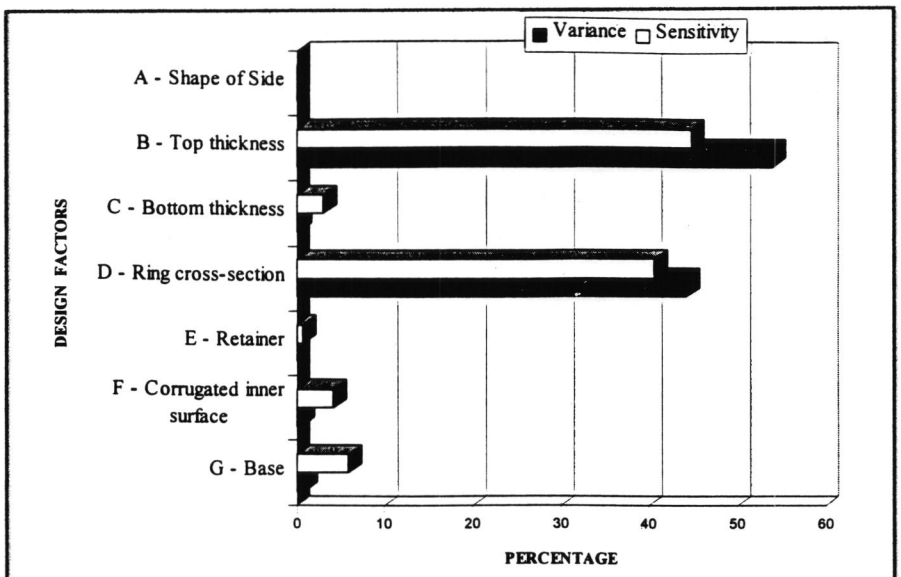


Figure 6. Comparison of variance and sensitivity values for the design factors of the conduit holder using the smaller-the-better signal-to-noise ratio.

Signal-to-noise ratios can be used simultaneously with appropriate maximum stress values to perform sensitivity, ANOVA, and loss function analysis.

Sensitivity Analysis

Sensitivity analysis can be helpful in identifying the levels for each factor that can positively influence the quality of the design. Figure 5 shows the sensitivity analysis for the conduit holder design. From figure 5 it is easy to identify A1B2C1D1E1F1G1 as the optimum design configuration.

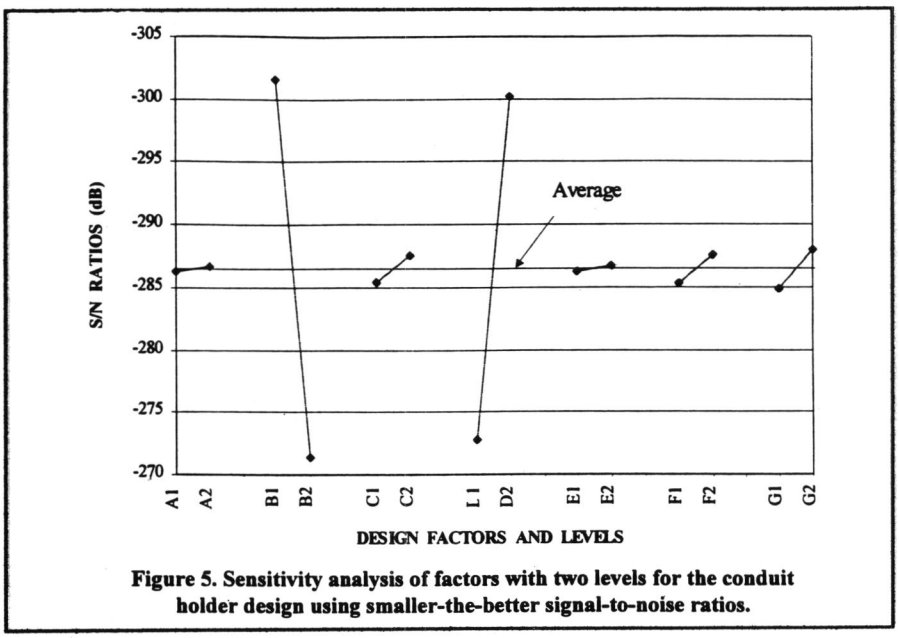


Figure 5. Sensitivity analysis of factors with two levels for the conduit holder design using smaller-the-better signal-to-noise ratios.

Analysis of Variance (ANOVA)

ANOVA identifies the factors that make the greatest contribution to the total variation in the analytical results. ANOVA is also used to verify the results from the sensitivity analysis. Reliability of the ANOVA results can be checked with the F test by comparing the calculated F* value to the F value from tables to obtain the confidence level for the ANOVA results. The ANOVA analyses for the conduit holder design was performed using the signal-to-noise ratios and the average highest maximum stress values. Simultaneous ANOVA analysis of these different data types can provide an extra measure of con-

fidence in the results. Figure 6 shows the variances and sensitivity values for the conduit holder design. Experiments have shown that sensitivity values can provide a fairly good estimate of the influence of each factor on reducing the variation in the design.

Loss Function Analysis

The quality of a product can be determined from the loss that the product causes to society during its manufacturing, use and recycling. The loss function can be used to compare and evaluate the quality of different design configurations. Figure 7 shows the Taguchi and a proposed loss function output with data obtained from the conduit holder design. In the expressions for the loss functions, m is the target value, D is the tolerance range, and k is a constant. The proposed loss function, as compared the Taguchi loss function, gives a lower loss within the tolerance range and a higher loss outside.

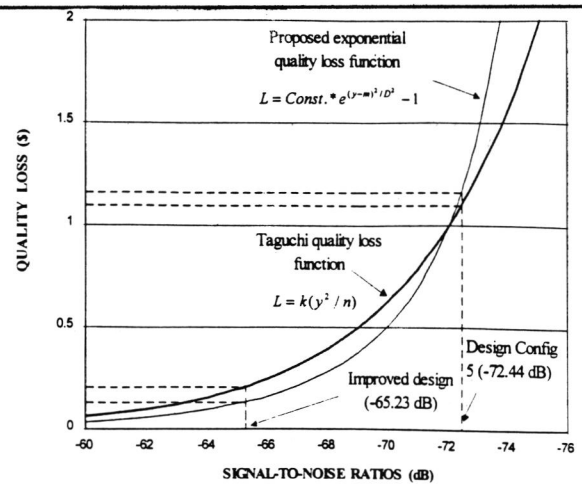


Figure 7. Quality loss for the conduit holder design using the smaller-the-better signal-to-noise ratio.

CONCLUSION

The validity of using SDE with FEA has been verified by application to several problems, including the design optimization of a conduit holder and a die casting process. This approach allows optimization of the product before any prototypes are built, thus reducing costs and lead time requirements for the product development process.

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Theta Tau Defies Stereotype

The movie "Animal House" typifies the impression most people have of fraternities as beer drinking party-animals. However, the co-ed engineering fraternity Theta Tau couldn't be farther from the stereotype.

For 48 years, Gamma Beta chapter of Theta Tau has made a positive contribution to SEAS. This academic year has been a resounding success in the three major facets of Theta Tau: professional development, academic achievement, and social activities.

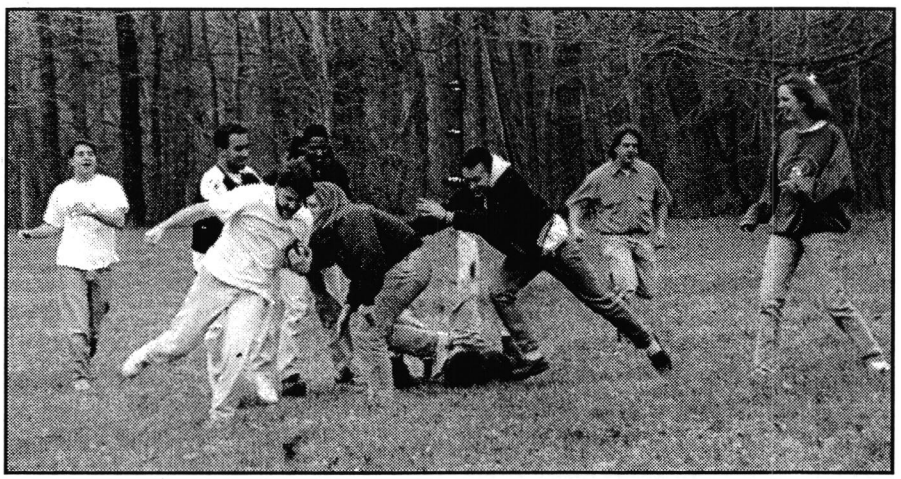
Historically, Theta Tau has been professionally successful. Brothers such as Congressman Cliff Stearns and Dr. Douglas Jones have obtained high standing in their careers, while giving back to GW. Friendships built and skills learned as a brother of Theta Tau assisted in their rise to success.

That tradition was continued this year. The 1995 Co-Op Student of the Year, David Sloan, was offered a position in Israel, where he now works for John Bryce Systems.

Additionally, Theta Tau sponsored many professional development events open to GW students. These included events on resume building techniques as well as job recruiters.

Brothers of Theta Tau strive to enhance SEAS. The project managers of GW Steel Bridge and GW Solar Car are brothers of Theta Tau. Also, the original and re-founding editors of MECHELECIV are brothers of Theta Tau.

Theta Tau brothers have also succeeded academically in the past year. Utilizing tutoring and test files, Theta Tau brothers support each other in their academic pursuits.



Theta Tau members enjoy a game of football at the annual Shrimp Feast. The event provides an opportunity for student members to spend time with Alumni.

In fact, Alex Rosenheim was honored with the Norman B. Ames award. The award is given to the most outstanding graduating senior.

The award is named for a GW alumnus and former professor. As a brother of Theta Tau, Ames helped to establish Gamma Beta Chapter and went on to become Theta Tau's National President.

Theta Tau brothers struggle to overcome the stereotype that engineers only study. Theta Tau sponsors a variety of functions designed for its members to relax and enjoy college.

This year, Theta Tau has covered a lot of ground, road tripping to Athens, OH; Austin, TX; Charlottesville, VA; Cookeville, TN; Hempstead, NY; New Orleans, LA; Raleigh, NC; and Syracuse, NY.

Road trips provide the opportunity to travel and meet a network of people across the county. They are also a lot of fun. This year, the annual road trip to Mardi Gras proved to be a highlight of the year for many of the brothers. Senior Erin Knight said, "Mardi Gras is definitely one of the best times I've had in college."

The annual Shrimp Feast gave student members the chance to interact with local alumni to celebrate the refounding of the chapter. Held at historical Fort Washington, the pleasant weather was perfect for a picnic.

Also, a luncheon cruise down the Potomac provided for an opportunity to appreciate D.C. This popular event has become a Gamma Beta tradition.

Theta Tau is an organization with a tradition of success, and its future is shining. To find out more about Theta Tau, check out the WWW page at URL http://www.seas.gwu.edu/student/thetatau.

~Aaron Kochar

ASME Enjoys Successful Year

Once again, the GW student chapter of the American Society of Mechanical Engineers has had a very successful year. We have had several exciting activities for engineering students, as has been the case in previous years.

Perhaps our most visible activity this year was the GW Engineering sweatshirt sale. This was the first time in five years that clothing bearing the engineering school's name has been made available to the University community, and it was anticipated that the demand would be high. As expected, our shipment of eighty sweatshirts sold out within a month.

ASME also organized two successful field trips this past fall. The first was to the United States Army Research Laboratory in Adelphi, Md. Students had the opportunity to interact with engineers working in various fields including fluidics, training weapons, and fuse technology. This trip provided some insight into a practicing engineer's daily routine, and the response was enthusiastic. Furthermore, Mr. John Hopkins, a scientist from the Advanced Concepts Branch of ARL, spoke to students at GW about training weapons, so students that were unable to go on the field trip were able to learn about some of the activities taking place at ARL.

The second field trip was to the United States Patent Office in Crystal City. There, students had the opportunity to learn about the process of obtaining patents as well as the patent library, the patent examining rooms, and the foreign language translation library. There was a large turnout for this field trip and most seemed to enjoy it.

ASME sponsors one of the centerpieces of Engineers' Week; namely, the Egg Drop Competition. This year we again had a large turnout and everybody had a lot of fun. The contestants competed for cash prizes, and there were newspaper and television reporters in attendance. One of the highlights of this year's competition was the large number of unbroken eggs. Hopefully, this trend will continue in the years to come.

Finally, this year we are starting a new project; one that we hope will provide a service to the School of Engineering. We hope to have a student member act as a liaison with the CMEE faculty and offer some feedback on what can be done to improve the School of Engineering. This project is still in the development stage; right now we are sending out surveys to ASME members to find out about issues of concern to students.

None of the above events would have been possible without the hard work done by the members of ASME, and for this they deserve recognition. We are confident that ASME will continue to attract dedicated mechanical engineering students and that ASME will continue to be a visible part of the University community.

~Aris Kyriakopoulos

Society Teaches Work Skills

Founded in 1884, The Institute of Electrical and Electronics Engineers (IEEE) is a worldwide technical professional society devoted to advancing the theory and application of electrical engineering, electronics and computing. IEEE serves over 310,000 electrical engineers, scientists and other professionals in approximately 150 countries. We're the world's largest technical professional society.

IEEE student membership offers the opportunity to develop the skills needed to be successful in today's complex work environment. IEEE membership, journals and Student Branch Activities help students by providing state of the art technical information, exposing the latest trends in industry, and helping make important personal contacts with working engineers. IEEE publishes the world's most comprehensive source of electrical and electronics publications, specialized books, conference records and published standards. Membership

(see *"IEEE"*, page 16)

Group Unites Career, Culture

The National Society of Black Engineers (NSBE), with more than 8,000 members nationally, is one of the largest student-managed organizations in the country. NSBE's mission is to increase the number of culturally responsible Black engineers to excel academically, succeed professionally, and to positively impact the community.

NSBE had its genesis at a national conference planned and hosted by the Society of Black Engineers at Purdue University in April 1975. Black engineering students from the United States and Canada attended this event.

NSBE's objectives are to:

- Stimulate and develop student interest in the various engineering disciplines
- Strive to increase the number of minority students studying engineering at both the undergraduate and graduate levels
- Encourage members to seek advanced degrees in engineering or related fields and to obtain professional engineering registrations
- Encourage and advise minority youth in their pursuit of an engineering career
- Function as a representative body on issues and developments that affect the careers of Black engineers.

New and innovative project ideas are generated and implemented throughout the year on the chapter, regional, and national levels. Some of NSBE's present activities include tutorial programs, group study sessions, high school/junior high outreach programs, technical seminars and workshops, a national communication network, two national magazines (NSBE Magazine and the NSBE Bridge), an internal newsletter, a professional newsletter (The Career Engineer), resume books, career fairs, awards, banquets, and an annual national conference.

The primary goal at GW is to strengthen the chapter and strive to meet and exceed the objectives of the organization. Besides selling the best baked goods on campus, the GW chapter of NSBE offers tutorial services, a test file, and academic excellence programs to strengthen the GPA's of everyone involved.

The chapter has established a 3.0 Crew where everyone involved is given the means necessary to obtain a 3.0 and better. The chapter is also in the process of establishing a scholarship for DC high school graduates.

The GW chapter is making strides to become a NSBE chapter that everyone would like to be a part of. The future of NSBE is unlimited. With the continued dedication of members and supporters, NSBE can and will achieve its full potential.

~Rosa Ayers

IEEE Promotes Technical Development

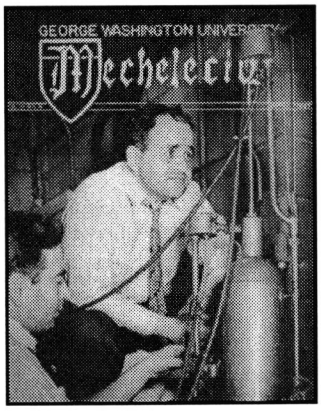
invites you to attend and participate in numerous technical conferences in a variety of technical interest areas as well as educational seminars, technical and professional programs and courses.

Some of this semester's are a Student Professional Awareness Conference, a field trip to the White House Communication Room, our Special Lecture series from engineers who work for INET, and a field trip to the National Institute of Health. A lecture by Professor Helm, director of research at GW, is also scheduled. He was formerly the director of laboratories at ComSat. We're not just about the boring technology stuff, we'll also have social gatherings where you can meet the professors here at GW who are IEEE members and other engineering students. In April, we rent out the GW double decker bus, and admire Washington's cherry blossoms.

If you are interested in IEEE, visit our homepage on the WWW. Our address is http://gwis2.circ.gwu.edu/~ieee. If you would like an application for membership, the D.H. house or the EECS department will be glad to give you one.

~Lanzhi Wang

Help Continue The Fine Tradition...



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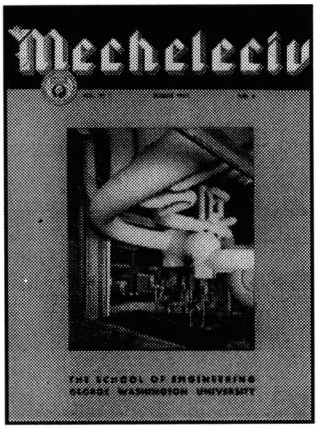

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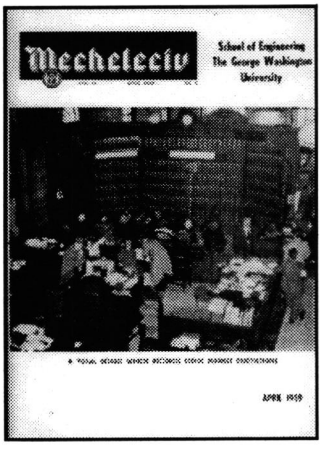

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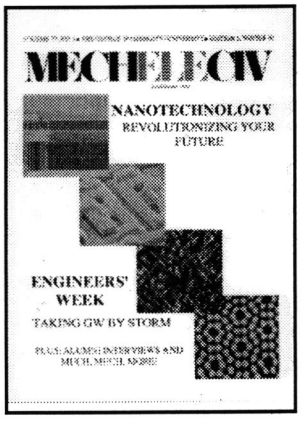

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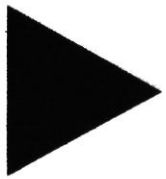
Look for planning meetings at the beginning of Fall 1996!



MECHELECIV
The George Washington University
2142 G st., N.W.
Washington, D.C. 20052